DEPARTMENT OF APPLIED HEALTH SCIENCES

Scheme & Syllabus of 8th Semester

B.Tech. (Electronics & Biomedical Engineering)

(w.e.f. 2024-25)

Guru Jambheshwar University of Science & Technology, Hisar, Haryana (125001), India

(Established by State Legislature Act 17 of 1995)
'A+' GRADE NAAC Accredited

Guru Jambheshwar University of Science and Technology
Hisar-125001, Haryana
('A+' NAAC Accredited State Govt. University)

Scheme & Syllabus of 8th Semester
B.Tech. (Electronics & Biomedical Engineering)
(w.e.f. 2024-25)

Name of the Programme: B.Tech. (Electronics & Biomedical Engineering)

		L	T	P	Total Hours	Credits	Internal	External	Total	Exam Hours
PEC-IV	Professional Elective - IV	3	0	0	3	3	30	70	100	3
PEC-V	Professional Elective - V	3	0	0	3	3	30	70	100	3
PCC-EBME402-T	Biomedical Signal Conditioning	3	0	0	3	3	30	70	100	3
PCC-EBME404-T	Biomechanics	3	0	0	3	3	30	70	100	3
PCC-EBME402-P	Biomedical Signal Conditioning Lab	0	0	2	2	1	50	50	100	3
PROJ-EBME-432-P	Major Project & Seminar	0	0	8	8	4	30	70	100	3
Total						**17**			**600**	

Or

Course Code	Course Name	L	T	P	Hours/Week	Credits	Internal	External	Total	Exam Hours
ITR	Full Semester Industrial Training EBME-442-P	--	--	--	--	**11**	--	--	--	--
Industrial Training with any 2 Program Core / Elective taken from the above list		--	--	--	--	**3+3**	--	--	--	--
Total						**17**				

List of Electives	
PEC-IV	**Professional Elective - IV**
PEC-EBME461-T	Advanced Medical Display Technologies
PEC-EBME462-T	Robotics & Automation in Medical Instrumentation
PEC-EBME463-T	Wireless Communication Assisted Medical Systems
PEC-EBME464-T	Advanced Mobile Communication
PEC-EBME465-T	Cloud Computing
PEC-V	**Professional Elective - V**
PEC-EBME466-T	Introduction to Bio-Metrics
PEC-EBME467-T	Medical Informatics
PEC-EBME468-T	Nanoelectronics
PEC-EBME469-T	Biochemical Analysis and Techniques
PEC-EBME470-T	Wireless Sensors and Networks
PEC-EBME471-T	Drone and Anti Drone Technology
Note: The MOOCS/SWAYAM/Equivalent course proposed/shortlisted by the students will be reviewed and finalized by the department committee consistingof chairperson, class coordinator/in-charge and subject teacher concerned to be appointed by chairperson committee will ensure that the course content ofthis course should not overlap more that 10% with subjects already covered in scheme and syllabus.	

SEMESTER-8

PROFESSIONAL ELECTIVES-IV
ADVANCED MEDICAL DISPLAY TECHNOLOGIES

Course Code: PEC-EBME461-T Course Credits: 3 Mode: Lecture (L) Type: Compulsory Contact Hours: 3 hours (L). Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carry equal marks.

Prerequisite: Basic knowledge of light optics and its features.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Acquire a basic knowledge of light optics.	LOTS: (Remember)
CO-2	To develop an ability to understand various display glasses & their features.	LOTS: L2 (Understand)
CO-3	To develop an understanding various display screens.	LOTS: L3 (Apply)
CO-4	Understanding of various mobile displays units.	HOTS: L4 & L5 (Analyze & Evaluate)

Unit-I

Properties of light, Geometric optics, optical modulation; vision and perception: anatomy of eye, light detection and sensitivity, spatial vision and pattern perception, binocular vision and depth perception; driving displays: direct drive,multiplex and passive matrix, active matrix driving, panel interfaces, graphic controllers, signal processing mechanism.

Unit-II

Display Glasses Inorganic Semiconductor TFT Technology, Organic TFT Technology; Transparent Conductors, Flexible Displays: Attributes, Technologies Compatible with Flexible Substrate and Applications, Touch Screen Technologies: Introduction, Coatings, Adhesive, Interfaces with Computer Mechanism.

Unit-III

Inorganic Phosphors, Cathode Ray Tubes, Vacuum Florescent Displays, Filed Emission Displays; Plasma Display Panels, LED Display Panels; Inorganic Electroluminescent Displays: Thin Film Electroluminescent Displays, AC Powder Electroluminescent Displays; Organic Electroluminescent Displays: OLEDs, Active Matrix for OLED Displays; Liquid Crystal Displays.

Unit-IV

Paper like and Low Power Displays: Colorant Transposition Displays, MEMs Based Displays, 3-D Displays, 3-D Cinema Technology, Autostereoscopic 3-D Technology, Volumetric and 3-D Volumetric Display Technology, Holographic 3-D Technology; Mobile Displays: Trans-reflective Displays for Mobile Devices, Liquid Crystal Opticsfor Mobile Displays, Energy Aspects of Mobile Display Technology.

Text Books:

1. Janglin Chen, Wayne Cranton, Mark Fihn, Handbook of Visual Display Technology, Springer Publication,2011.
2. Achintya K. Bhowmik, Mobile Displays: Technology and Applications, 2008.

Reference Books:

1. Xinyu Zhu, ZhibingGe, and Shin-Tson Wu, Transflective Liquid Crystal Display Technologies, 2010.
2. BahramJavidi, Fumio Okano, Three-Dimensional Television, Video, and Display Technologies, 2002.

ROBOTICS & AUTOMATION IN MEDICAL INSTRUMENTATION

Course Code: PEC-EBME-462-T Course Credits: 3 Mode: Lecture (L) Type: Compulsory Contact Hours: 3 hours (L). Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minortests, each of 20 marks, will be conducted. The third minor will be conducted in open bookmode by the Course Coordinator. No date sheet will be issued for the third minor at the levelof the Departments. For the purpose of internal assessment, the average of the highest marksobtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage oflectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, ninequestions are to be set by the examiner. Question number one will be compulsory and basedon the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carryequal marks.

Prerequisite: Basic knowledge of sensor & programing techniques of robotic systems.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Acquire a basic knowledge of robotic System.	LOTS: (Remember)
CO-2	To develop an ability to understand the sensors & visionary components for robotic System.	LOTS: L2 (Understand)
CO-3	To develop an understanding about the programing techniques of robotic systems.	LOTS: L3 (Apply)
CO-4	Understanding of various applications of robotic systems in medical field.	HOTS: L4 & L5 (Analyze & Evaluate)

Unit-I

Robotics, Basic components, Classification, Performance characteristics, Drives and control systems, Electric,hydraulic and pneumatic actuators, control loops using current amplifier and voltage amplifiers.

Unit-II

Sensors and vision systems: Transducers and sensors, Tactile sensors Proximity and range sensors, vision systems,Image processing and analysis, image data reduction, segmentation feature extraction, Object recognition.

Unit-III

End effects, type Mechanical grippers, vacuum cups magnetic grippers, robot end effectors interface software forindustrial robots. Positive stop program, point to point program and continuous path program.

Unit-IV

Applications: Telepresence, Surgical Assistants, Rehabilitation Robots, Medical Transportation Robots, Sanitationand Disinfection Robots, Robotic Prescription Dispensing

Systems.

Text Books:

1. S. R. Deb, Robotics Technology and Flexible Automation, 2001
2. Achim Schweikard, Floris Ernst, Medical Robotics, 2015.
3. Shane (S.Q.) Xie, Advanced Robotics for Medical Rehabilitation: Current State of the Art and RecentAdvances (Springer Tracts in Advanced Robotics) 2016.

Reference Books:

1. Mikell P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, 2014.
2. Thomas R. Kurfess, Robotics and Automation Handboo k, 2014.

WIRELESS COMMUNICATION ASSISTED MEDICAL SYSTEMS

Course Code: PEC-EBME-463-T Course Credits: 3 Mode: Lecture (L)Type: Compulsory Contact Hours: 3 hours (L). Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minortests, each of 20 marks, will be conducted. The third minor will be conducted in open bookmode by the Course Coordinator. No date sheet will be issued for the third minor at the levelof the Departments. For the purpose of internal assessment, the average of the highest marksobtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, ninequestions are to be set by the examiner. Question number one will be compulsory and basedon the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carryequal marks.

Prerequisite: Basic knowledge wireless communication & networking.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Acquire a basic knowledge in Wired Networks.	LOTS: (Remember)
CO-2	To develop an ability to understand the basics of wireless networks & its components.	LOTS: L2 (Understand)
CO-3	To develop an understanding various wireless networks topology.	LOTS: L3 (Apply)
CO-4	Understanding of hardware & application of wireless networks.	HOTS: L4 & L5 (Analyze & Evaluate)

Unit-I

Wired Networks, Wireless Networks, Applications of Wireless Networks, RF Fundamentals & parameters,Principles of antennas, Wireless Networks organizations and standards.

Unit-II

Basics of Wireless Networks: Classifications, Single hop and multihop, Aggregating and non-aggregating, Structuredand randomly deployed, Self-configurable and non-self-configurable.

Components: End devices, Routers, Coordinators, Operating modes, Cyclic, Event driven, Polled

Unit-III

Network topologies, issues for topology design, Core Challenges- Power consumption and battery lifetime, Bandwidth and response time, Reliability and stability.

Unit-IV

Hardware: Single node hardware: Sensors for WSN, Microcontrollers, Transceivers, Wireless communicationnetworks as embedded systems.

Wireless communication based medical instrumentation systems.

Text Books:

1. Wireless Communications: Theodore S. Rappaport; Pearsons, 2002.
2. Mobile Cellular Telecommunication: W.C.Y.Lee; McGraw Hill, 2008.

Reference Books:

1. Mobile Communications: Jochen Schiller; Pearson, 2014.
2. Modern Digital & Analog Communication System: B.P. Lathi, 2011.
3. Communication System: Symon Haykin, 2013.

ADVANCED MOBILE COMMUNICATION

Course Code: PEC-EBME-464-T Course Credits: 3 Mode: Lecture (L)Type: Compulsory Contact Hours: 3 hours (L). Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minortests, each of 20 marks, will be conducted. The third minor will be conducted in open bookmode by the Course Coordinator. No date sheet will be issued for the third minor at the levelof the Departments. For the purpose of internal assessment, the average of the highest marksobtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, ninequestions are to be set by the examiner. Question number one will be compulsory and basedon the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carryequal marks.

Prerequisite: Communication System.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Define the significance of communication in daily life.	LOTS: (Remember)
CO-2	Explain the evolution of mobile communication & technology over the years.	LOTS:L2 (Understand)
CO-3	Use the theory of communication in different scenario.	LOTS: L3 (Apply)
CO-4	Compare the speed of LTE and 5G, 6G in cellular communications.	HOTS: L4 (Analyze)
CO-5`	Evaluate various type of applications of 5G, 6G and advanced technique in cellular communications.	HOTS: L5 (Evaluate)

Unit-I

Evolution from 1G To 5G, LTE Features and Architecture, Introduction to 5G Communication, Architecture, New Radio, Massive MIMO, Potentials and Applications of 5G, Uses Scenarios, Spectrum for 5G, 5G Deployment, Challenges and Applications

Unit-II

Enhanced Mobile Broadband (eMBB), Ultra Reliable Low Latency Communication (uRLLC), MassiveMachine Type Communication (MMTC), D2D Communication, V2X Communication, Spectrum for 5G, Spectrum Access/ Sharing, Millimetre Wave Communication.

Unit-III

OFDM, Non-Orthogonal Multiple Access (NOMA), Carrier Aggregation 5G NR Requirements, 5G Core Network Architecture-Radio-Access Network (RAN), Radio Protocol Architecture-User Plane Protocols, Control Plane Protocols, Network Slicing-RAN Virtualization.

Unit-IV

6G Current Research and Initiatives, 6G Opportunities and Applications, 6G Network, Securities andChallenges.

Text Books:

1. 6G: The Road to The Future Wireless Technologies 2030. Ramjee Prasad. River Publishers Series.
2. Wireless Communication System Architecture Trans receiver Design and DSP towards 6G, Khaled SalahMohamed, Springer.

Reference Books:

1. Saad Z. Asif, "5G Mobile Communication Concepts and Technologies, CRC Press, 1st Edition 2019.
2. ERIK Dahlman, Stefan Parkwall, Johan Skold. "5G NR: The Next Generation Wireless Technologies"Academic Press. 1st Edition 2018.

CLOUD COMPUTING

Course Code: PEC-EBME-465-T Course Credits: 3 Mode: Lecture (L) Type: Compulsory Contact Hours: 3 hours (L). Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minortests, each of 20 marks, will be conducted. The third minor will be conducted in open bookmode by the Course Coordinator. No date sheet will be issued for the third minor at the levelof the Departments. For the purpose of internal assessment, the average of the highest marksobtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, ninequestions are to be set by the examiner. Question number one will be compulsory and basedon the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carry equal marks.

Prerequisite: Basic knowledge of cloud computing. And its concepts.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Define concepts related to cloud computing.	LOTS: L1(Remember)
CO-2	Express deployment models for clouds.	LOTS:L2 (Understand)
CO-3	Apply cloud computing techniques for various applications.	LOTS: L3 (Apply)
CO-4	Analyse cloud computing services used at various levels and to Assess real time cloud services.	HOTS: L4(Analyze)

Unit-I

Introduction: Distributed Computing, Cluster Computing, Grid Computing, Overview of Cloud Computing, History of Cloud Computing, Defining a Cloud, Benefits of Cloud Computing, Cloud Computing Architecture,Services Models (XaaS), Infrastructure as a Service, Platform as a Service, Software as a Service.

Unit-II

Deployment Models, Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Dynamic Provisioning and Resource Management, Virtualization: Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Pros and Cons of Virtualization, Xen, VMware, Hyper-V.

Unit-III

Cloud Platform in Industry: Amazon Web Services- Compute Services, Storage Services, Communication Services, Additional Services, Google App Engine- Architecture and Core Concepts, Application Life Cycle, Cost Model, Microsoft Azure-Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance

Unit-IV

Cloud Application: Scientific Applications- ECG Analysis in cloud, Protein Structure Prediction, Gene Expression data analysis for Cancer Diagnosis, Satellite Image

Processing, Business and Consumer Applications-CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online gaming. Cloud Security.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola and S ThamaraiSelvi, Mastering Cloud Computing, Tata McGraw Hill Education Pvt. Ltd., 2013
2. Kai hwang,geofferyu C.fox and Jack J.Dongarra, distributed and cloud computing , Elsevier,2012

Reference Books:

1. John W. Ritting and James F. Ransome, cloud computing: Implementation management and security, CRCpress, 2012

PROFESSIONAL ELECTIVES-V

INTRODUCTION TO BIO-METRICS

Course Code: PEC-EBME -466-T Course Credits: 3 Mode: Lecture(L) Type: Compulsory Contact Hours: 3h (L) Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30;External: 70)** Three minor tests, each of 20 marks, will be conducted. Thethird minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level ofthe Departments. For the purpose of internal assessment, the average of thehighest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be preparedand evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2marks). The end-semester examination will be of 70 marks. For the end-semester examination, nine questions are to be set by the examiner. Questionnumber one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carry equal marks.

Prerequisite: Understanding the concept of biometrics.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Understanding the concept of biometrics.	LOTS: (Remember)
CO-2	Understanding the design considerations of biometric systems & components.	LOTS: L2 (Understand)
CO-3	Knowledge of engineering concerns of different biometric technologies.	LOTS: L3 (Apply)
CO-4	Understanding the applications of biometric systems and future trends.	HOTS: L4 (Analyze)

Unit-I

Introduction to Bio-Metrics: Definition of Biometric, Characteristics of Biometrics, Nature of Biometrics, Types of Biometrics, Need of Biometrics, Verification and Identification.

Unit-II

Types of Bio-Metrics: Introduction of all possible biometrics such as Fingerprint, Face, Iris, Palm print, Hand vein, Hand Shape and their features.

Unit-III

Bio-Metric Technology and Systems: Fingerprint Biometric Technology, Face Biometric Technology, Iris Biometric Technology, Voice Biometric Technology.

Face Bio-Metric System: Design of Face Bio-Metric using Principal Component Analysis and DiscriminantAnalysis.

Unit-IV

Applications of Bio-Metrics: Security access, Police and prison services, Patient management in hospitals, Casinofacial recognition, Enterprise network security and web access, Other areas of application. Future Trends in Bio- Metrics - Multimodal Biometrics, surveillance.

Text Books:

1. Samir Nanavati, Raj Nanavati, Michael Thieme, “Biometrics: Identify Verification in a Networked World”,Wiley-Dremtech India Pvt Ltd, 2003.
2. Paul Reid, “Biometrics for Network Security”, Prentice Hall, 2003.

Reference Books:

1. Julian Ash bourn “Biometrics: Advanced Identify Verification: The Complete Guide”, Springer-Verlag, 2000.
2. Anil K. Jain, Patrick Flynn, Arun A. Ross, “Handbook of Biometrics”, Springer,2008.

MEDICAL INFORMATICS

Course Code: PEC-EBME -467-T Course Credits: 3 Mode: Lecture(L) Type: Compulsory Contact Hours: 3h (L) Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30;External: 70)** Three minor tests, each of 20 marks, will be conducted. Thethird minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level ofthe Departments. For the purpose of internal assessment, the average of thehighest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be preparedand evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2marks). The end-semester examination will be of 70 marks. For the end-semester examination, nine questions are to be set by the examiner. Questionnumber one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carry equal marks.

Prerequisite: Knowledge and understanding of basic Medical Informatics.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Understand the basic concepts in medical Informatics.	LOTS: (Remember)
CO-2	Understand the basics of bioinformatics and the resources in the field.	LOTS: L2 (Understand)
CO-3	Apply the various aspects of health informatics and medical standards.	LOTS: L3 (Apply)
CO-4	Design and develop clinical decision support systems and apply the various bioinformatics tools and databases available in NCBI.	HOTS: L4 (Evaluate)

Unit-I

Introduction to Biomedical Informatics: The Science and the Pragmatics - Biomedical Data - Their Acquisition, Storage, and Use - Computer Architectures for Health Care and Biomedicine - Overview of hospital information system – Patient history taking mechanisms - Patient data processing - Database Management - Communication of medical data across different hospital units - Networking and Integration of patient data. Basic of Biomedical Decision Making.

Unit-II

Computer Architectures and Software Engineering for Health Care and Biomedicine : Data from patients - Patient Record, Coding and classification – Standards - Natural Language Processing - Biomedical ImagingInformatics - Bio signal Analysis - Electronic Health Record Systems- Patient-Centered Care Systems - Primary care - Clinical Departmental Systems - Nursing Information Systems.

Unit-III

Electronic Patient Record and Standards: Electronic Patient Record - Medical data

formats – Medical Standards – HL7 – DICOM - LOINC -PACS - Medical Standards for Vocabulary - ICD 10 – DRG - MeSH, UMLS,SNOMED - Healthcare Standards - JCAHO, HIPAA.

Unit-IV

Bioinformatics: Introduction to Bioinformatics- Biological information resources - Genome sequence acquisitionand analysis - Retrieval of biological data - Data acquisition – databases - structure and annotation – Data, Methodology for Information Systems.

Text Book:

1. Edward H. Shortliffe and James J. Cimino, "Biomedical Informatics: Computer Applications in Health Careand Biomedicine (Health Informatics)", 2014, 4th edition, Springer, New York.

Reference Book:

1. Rastogi, "Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery", 2013, 1st edition, Prentice Hall, New Delhi.

NANOELECTRONICS

Course Code: PEC-EBME-468-T Course Credits: 3 Mode: Lecture (L) Type: Compulsory Contact Hours: 3 hours (L). Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations willbe considered. All the minor examination question papers will be prepared and evaluatedby following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks)and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Restof the eight questions is to be given by setting two questions from each of the four unitsof the syllabus out of which student have to attempt at least one question from each unit.All questions carry equal marks.

Prerequisite: Basic knowledge of Electronics, Fundamentals of Mechanical Engineering.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Define the terminologies and fundamental principle related to UAV Drone and Anti-Drone.	LOTS: (Remember)
CO-2	Understand and explain the operation of components & various deign units of Drone and Anti-Drone systems.	LOTS:L2 (Understand)
CO-3	Apply the knowledge of technical and operational requirements for Drone and Anti-Drone.	LOTS: L3 (Apply)
CO-4	Anlyze the performance parameters of Drone and Anti-Drone subsystem.	HOTS: L4 (Analyze)
CO-5	Evaluate the parameters of Drone and Anti-Drone subsystem for a given application.	HOTS: L5 (Evaluate)

Unit-I

Introduction: Recent past, the present and its challenges, Future, Overview of basic Nano electronics.

Nano electronics & Nanocomputer architectures: Introduction to Nanocomputers, Nanocomputer Architecture, Quantum DOT cellular Automata (QCA), QCA circuits, Single electron circuits, molecular circuits, Logic switches – Interface engineering – Properties (Self-organization, Size-dependent) – Limitations.

Unit-II

Nanoelectronic Architectures: Nanofabrication – Nanopatterning of Metallic/Semiconductingnanostructures (e-beam/X-ray, Optical lithography, STM/AFM-SEM & Soft-lithography) – Nano phase materials – Self assembled Inorganic/Organic layers.

Unit-III

Spintronics: Introduction, Overview, History & Background, Generation of Spin

Polarization Theories of spin Injection, spin relaxation and spin dephasing, Spintronic devices and applications, spin filters, spin diodes, spintransistors.

Unit-IV

Memory Devices and Sensors: Memory devices and sensors, Nano ferroelectrics, Ferroelectric random access memory (Fe-RAM) circuit design, ferroelectric thin film properties and integration, calorimetric sensors, electrochemical cells, surface and bulk acoustic devices, gas sensitive FETs, resistive semiconductor gassensors, electronic noses, identification of hazardous solvents and gases, semiconductor sensor array.

Text Books:

1. Nanoelectronics & Nanosystems: From Transistor to Molecular & Quantum Devices: KarlGoser, JanDienstuhl and others.
2. Nano Electronics and Information Technology: Rainer Waser

Reference Books:

1. Concepts in Spintronics – Sadamichi Maekawa
2. Spin Electronics – David Awschalom.

BIOCHEMICAL ANALYSIS AND TECHNIQUES

Course Code: PCC-EBME469-T Course Credits: 3 Mode: Lecture (L)Type: Compulsory Contact Hours: 3 hours (L). Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the averageof the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measuredthrough the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of theeight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carry equal marks.

Prerequisite: Basic knowledge of Biochemical and its concepts.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Comprehend the basic concepts of biomolecules and its functional classification	LOTS: (Remember)
CO-2	Ability to understand the metabolism of carbohydrates, proteins and fats with its factors affecting and deficiency disorders.	LOTS: L2 (Understand)
CO-3	Comprehend the mechanism of enzymes and its classification with its modes of action.	LOTS: L3 (Apply)
CO-4	Ability to understand the concepts and types of hormones, its physiological actions and immune system	HOTS:L4 (Analyze)
CO-5	Comprehend the knowledge on composition and functions of blood, formation of urine, composition of urine – creatinine, urea, albumin and sugar.	HOTS: L5 (Analyze)
CO-6	Ability to understand the instrumentation and principle concepts of Hemocytometer, organ function tests, microscopy and various analytical techniques.	HOTS: L6(Evaluate)

Unit-I

Biomolecules: Carbohydrates – General classification - Structure and functions - Lipids structure and function - storage lipids - Structure of proteins and amino acids – Conformation – Classification - Denaturation.

Unit-II

Metabolism: Carbohydrate - Blood glucose regulation - Hypo and hyperglycemia - Diabetus mellitus-types – Clinical features - Metabolic changes – Glycosuria – GTT – Amino acids – Phenylketonuria - Lipids and Lipoproteins- Cholesterol- Factors affecting the level - Plasma lipoprotein – Types - Hyperand hypo-lipo proteinemias - Risk factor - Atheroscelorosis and fatty liver.

Unit-III

Introduction to enzymes and hormones: Classification – chemistry - Nomenclature properties and mode of action of enzymes - Factor affecting enzyme activity - Concepts and types of hormones - Hormone actions – Pituitary – Thyroid – Parathyroid - Endocrine pancreas - Blood glucose regulation -Sex hormones and their functions -Immune system.

Basic Analytical techniques, Clinical analytical methods. basic Biological and physiochemical parameters.

Unit-IV

Blood and urine identification factors: Blood and urine - Composition and functions - Types and functions of RBC - WBC and platelet – Urine profile (creatinine – urea – albumin - sugar) - Color of urine
- Specific gravity.

Text Books and Reference Books:

1. Internet of Things, Principles and Paradigms; Rajkumar Buyya. Elsevier.
2. The Internet of Things: From RFID to the Next Generation Pervasive Networked Lu Yan. Yan Zhand.Laurence T. Yang, Huansheng Ning.
3. Internet of Things (A Hands-on-Approach), Vijay Madisetti, Arshdeep Bahga
4. Designing the Internet of Things, Adrian McEwen (Author). Hakim Cassimally
5. Computer Networks; By: Tanenbaum, Andrew S. Pearson Education Pvt. Ltd. Delhi, 4th Edition.
6. Data and Computer Communications; By: Stalling. William: Pearson Education Pvt. Ltd. Delhi 6th Edition.
7. Cloud Computing Bible, Barrie Sosinsky, Wiley-India 2010CO-PO Articulation Matrix

WIRELESS SENSORS AND NETWORKS

Course Code: PEC-EBME-470-T Course Credits: 3 Mode: Lecture (L)Type: Compulsory Contact Hours: 3 hours (L). Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minortests, each of 20 marks, will be conducted. The third minor will be conducted in open bookmode by the Course Coordinator. No date sheet will be issued for the third minor at the levelof the Departments. For the purpose of internal assessment, the average of the highest marksobtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, ninequestions are to be set by the examiner. Question number one will be compulsory and basedon the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carryequal marks.

Prerequisite: Communication System and Computer Networks.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Outline the terminology, general architecture and application areas of wireless sensor networks.	LOTS: (Remember)
CO-2	Explain the working of WSNs with the help of various MAC,routing and transport control protocols.	LOTS:L2 (Understand)
CO-3	Apply the knowledge gained to address, the design issues and challenges involved in wireless sensornetworks.	LOTS: L3 (Apply)
CO-4	Analyze the working and performance of various WSN protocols and systems.	HOTS: L4 (Evaluate)

Unit-I

Introduction: Basic Concept Of WSN, Characteristics Requirements of WSN, WSN vs AdHoc Networks, Challenges for WSNs, Applications Examples; Sensors Node Architecture: Hardware Components, Energy Consumption, Example of Sensors Nodes: Design Principle of WSNs.

Unit-II

MAC protocols for WSN: fundamentals of MAC protocols, low duty cycle protocols and wake-up concepts,contention-based protocols, scheduled based protocols, IEEE 802.15.4 MAC protocols.

Unit-III

Routing Protocols for WSN: Basics of Forwarding and Routing, Challenges and Design Issues, Gossiping and Agent Based Uni-Cast Forwarding, Energy Efficient Unicast, Broadcast and Multicast, Geographic Routing, Mobile Notes, Data Centring Routing, Data Aggregation.

Unit-IV

Transport Control Protocols For WSN: Design Issues, Transport Layer and QoS in WSN, Coverage and Deployment, Reliability Requirements, Single Packet Delivery, Block Delivery, Congestion Control and Rate Control.
Design Issue in Operating Systems for WSNs and OS Examples: Securities Consideration In WSNs.

Text Books:

1. H. Karl and A. willing. “Protocols and Architecture for Wireless Sensor Networks”. John Wiley and Sons 2005.
2. K. Sohnaby, Monoli. And T. Zanti. “Wireless Sensor Networks: Protocols and application”. John Wiley andSons 2007.

Reference Books:

1. C.s. Raghavendra K M sivalingam and T. Zanti. . “Wireless Sensor Networks”. Springer Verlag. Sept 2006.
2. W.Dargie . C Poellabauer. “Fundamentals of Wireless Sensor Networks: Theory and Practice.” John Wiley andSons 2010.

DRONE AND ANTI-DRONE TECHNOLOGY

Course Code: PEC-EBME-471-T Course Credits: 3 Mode: Lecture (L)Type: Compulsory Contact Hours: 3 hours (L) Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minortests, each of 20 marks, will be conducted. The third minor will be conducted in open bookmode by the Course Coordinator. No date sheet will be issued for the third minor at the levelof the Departments. For the purpose of internal assessment, the average of the highest marksobtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, ninequestions are to be set by the examiner. Question number one will be compulsory and basedon the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carryequal marks.

Prerequisite: Basic knowledge of Electronics, Fundamentals of Mechanical Engineering.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Define the terminologies and fundamental principle related to UAV Drone and Anti-Drone.	LOTS: (Remember)
CO-2	Understand and explain the operation of components & various deign units of Drone and Anti-Drone systems.	LOTS:L2 (Understand)
CO-3	Apply the knowledge of technical and operational requirements for Drone and Anti-Drone.	LOTS: L3 (Apply)
CO-4	Anlyze the performance parameters of Drone and Anti-Drone subsystem.	HOTS: L4 (Analyze)
CO-5	Evaluate the parameters of Drone and Anti-Drone subsystem for a given application.	HOTS: L5 (Evaluate)

Unit-I

Introduction to UAV and Payloads: Unmanned Aerial Vehicle, Historical Aspects of UAV, Classification of UAVs, applications, deployment restriction on UAVs, Small UAVs, System Composition, Introduction to Design and Selection of the System: Conceptual Design, Preliminary Design, Detail Design, Selection of the System, Payload: Dispensable and Non-Dispensable Payload, Payload Types, Cargo Height, Surveillance Military.

Unit-II

UAV Design and Navigation: Lift Induced Drag, Parasitic Drag Rotatory-Wing Aero-Dynamics, Response to Air Turbulence, Airframe Configuration: HTOL, VTOL, Hybrids (Convertible Rotar Aircraft), Design for Stealth: Acoustic, Visual, Radio and Radar Signatures, Inertial Navigation Systems, GPS, Element of GuidanceSystem, Guidance Laws, Line of Sight Guidance Law, Waypoint Guidance, Ground Control Subsystems, Primary Subsystem of Auto Pilot.

Unit-III

Drone Design, Safety and Regulations: Introduction to Drone and Their Applications, India and Drones, Tinkering and Drones, Classification of Drone Based on Their Structure,

Dynamics of An Aerial System, Stability and Control Drone Sensors: Accelerometer, Barometer, Gyro Meter, Magnetometer, Thermal Chemical, Distance Sensors, Propulsion and Vertical Motion, Batteries of The Drone Building Your Own Drone, Key Features of Drone Regulation, Future of Drone.

Unit-IV

Introduction To Anti-Drone Technology: Need For Anti- Drone Systems, System Requirement, Drone Detection identification , Localization And Tracking ,Drone Neutralization, Jamming And Countering Techniques, Anti-Drone System Guidelines, Detector Deployment, Threat Level Assessment, RiskManagement, Advances Technology, Anti-drone Nullification Technology, Anti- Drone System Advances, Challenges in Countering.

Text Books:

1. Unmanned Aircraft Design: A Review of Fundamentals, Synthesis Lectures on Mechanical Engineering,Mohammad Sadraey, Morgan & Claypool Publishers Series.2017.
2. Unmanned Aircraft System: UAVs Design, Development and Deployment, Reg

Reference Books:

1. Theory, Design and Application of Unmanned Aerial Vehicles, A. R. Jha. CRC Press.2016.
2. Counter-Drone System Arthur Holland Michel. The Centre For The Study of the Drone at Bard College.

BIOMEDICAL SIGNAL CONDITIONING

Course Code: PCC-EBME-402-T Course Credits: 3 Mode: Lecture (L) Type: Compulsory Contact Hours: 3 hours (L). Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minorwill be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. Forthe purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performancewill be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carry equal marks.

Prerequisite: Basic knowledge of Operation Amplifier and biomedical signal.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	To describe the aim, purpose and use of signal conditioning in biomedical instrumentation.	LOTS: (Remember)
CO-2	To describe the various important characteristics of operational amplifiers.	LOTS:L2 (Understand)
CO-3	To get acquainted with various popular operational amplifiers.	LOTS: L3 (Apply)
CO-4	Able to understand and design of various signal conditioning circuits for biomedical applications.	HOTS: L4 (Analyze)

Unit-I

Biomedical Signals and Artefacts: Elements of generalized medical instrumentation system, Nature of signal and noise, types of noise, interfering and modifying signals, methods of correction for interfering and modifying inputs, Acquisition of biomedical signals, examples of biomedical noisy signals, artefacts in biomedical signals,requirement of Signal conditioning, pre amplifier and its need.

Unit-II

Linear Op-Amp Circuits: Introduction to OP-Amp, Inverting and non-inverting amplifier, OP-Amp parameters, equivalent circuit of Op-Amp, differential input – differential output amplifier. The 741 Op-Amp, Inverter/ Non-inverter circuits, differential amplifier, instrumentation amplifier, summing amplifier, current boosters, and voltage-controlled sources.

Unit-III

Non-Linear Op-Amp Circuits: Comparators with zero and non-zero reference, Comparators with hysteresis, window comparator, Integrator, differentiator, waveform conversion, waveform generation, Triangular wave generator, active diode circuits.

Unit-IV

Active Filters and circuits: Introduction, Ideal responses, Advantages over passive filters, First order filters, High orders filters, VCVS Equal-component low-pass filter, VCVS High-pass filter, MFB band pass filter, Bandstop filter, All pass filter, IC 555 Timer- Functional block diagram, Application of 555 Timer as a stable multivibrator, Monostable multivibrator and Voltage controlled Oscillator (VCO).

Text Books:

1. John G. Webster, "Medical Instrumentation" third edition, published by John Wiley & Sons (Asia) Pte Ltd.,2Clementi Loop, Singapore.
2. Malvino Albert and bates David J, "Electronic Principles", published by McGraw Hill Education Pvt. Ltd.,New Delhi.
3. Sawhney A.K., "Electrical and Electronic Measurements and Instrumentation", published by Dhanpat Rai and Co. Pvt. Ltd., Delhi.

BIOMECHANICS

Course Code: PCC-EBME 404-T Course Credits: 3 Mode: Lecture(L) Type: Compulsory Contact Hours: 3h (L) Examination Duration: 03 hours.	**Course Assessment Methods; Max. Marks: 100 (Internal: 30; External: 70)** Three minor tests, each of 20 marks, will be conducted. The third minor will be conducted in open book mode by the Course Coordinator. No date sheet will be issued for the third minor at the level of the Departments. For the purpose of internal assessment, the average of the highest marks obtained by a student in any two minor examinations will be considered. All the minor examination question papers will be prepared and evaluated by following the Outcome Based Education framework. Class Performance will be measured through the percentage of lectures attended (4 marks) Assignments (4 marks) and class performance (2 marks). The end-semester examination will be of 70 marks. For the end-semester examination, nine questions are to be set by the examiner. Question number one will be compulsory and based on the entire syllabus. It will contain seven short answers type questions. Rest of the eight questions is to be given by setting two questions from each of the four units of the syllabus out of which student have to attempt at least one question from each unit. All questions carry equal marks.

Prerequisite: Basic knowledge and understanding of mechanics relevant to human body.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Understanding the principles of mechanics relevant to human body.	LOTS: (Remember)
CO-2	Understanding the various aspects of hard & soft tissue mechanics.	LOTS:L2 (Understand)
CO-3	Knowledge of biomechanics of joints & locomotion.	LOTS: L3 (Apply)
CO-4	Understanding the concept and principles of fluid mechanics.	HOTS: L4 (Analyze)

Unit-I

Introduction to mechanics: Review of the principles of mechanics, Vector mechanics-Resultant forces of Coplanar & Non-coplanar and Concurrent & non-concurrent forces, parallel force in space, Equilibrium of coplanar forces, Newton's laws of motion, work and energy, Moment of inertia, Laminar flow, Turbulent flow,Couette flow and Hagen-Poiseuille equation.

Unit-II

Hard Tissue Mechanics: Mechanical properties of bone, cortical and cancellous bones, viscoelastic properties,Maxwell &Voight models – anisotropy, Electrical properties of bone.

Soft Tissue Mechanics: Pseudo elasticity, nonlinear stress-strain relationship, Viscosity, Structure, Function and mechanical properties of skin, ligaments and tendons.

Unit-III

Biomechanics of Joints: Skeletal joints, Skeletal muscles, Mechanics of elbow, mechanics of shoulder, mechanics of spinal column, mechanics of hip, mechanics of knee.

Locomotion: Human locomotion, Gait analysis and goniometry, Ergonomics, Foot

Pressure measurements – Pedobarograph, Force platform, Mechanics of foot.

Unit-IV

Flow Dynamics of Circulatory System: Ventricular pressure& volume, ECG time based cyclic variation. Determination of ventricular wall diastolic, systolic modulus vs stress properties and their physiological connotation. Arterial impedance relating pulse pressure and flow rate, Microcirculatory flow, Transcapillary fluid movements in systemic circulation.

Text Books:

1. NihatOzkaya and Margareta Nordin, "Fundamentals of Biomechanics: Equilibrium, Motion, andDeformation", Springer- Verlag; Second Edition, 1999.
2. Susan J Hall, "Basic Biomechanics", McGraw Hill, Columbus - OH, Second Edition, 1995.
3. Fung Y C, "Biomechanics: mechanical properties of living tissues", Second Edition. Springer-Verlag,1993.

Reference Books:

1. Arthur T Johnson, "Biomechanics & Exercise Physiology", John Wiley & Sons, NY, 1991.
2. Ghista D N, "Biomechanics of Medical Devices", Macel Dekker, 1982.

BIOMEDICAL SIGNAL CONDITIONING LAB

Course Code: EBME-402-P Course Credits: 2 Type: Compulsory Contact Hours: 2 hours/week Mode: Practical session of 2hours	**Course Assessment Methods (Internal: 30; External: 70)** Internal continuous assessment of 30 marks on the basis of class performance and attendance in practical classes. For the end semester practical examination, the assessment will be done out of 70 marks by the external and internal examiners.

Prerequisite: Basic knowledge and understanding of biomedical signal.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	To describe the aim, purpose and use of signal conditioning in biomedical instrumentation.	LOTS: (Remember)
CO-2	To describe the various important characteristics of operational amplifiers.	LOTS:L2 (Understand)
CO-3	To get acquainted with various popular operational amplifiers.	LOTS: L3 (Apply)
CO-4	Able to understand and design of various signal conditioning circuits for biomedical applications.	HOTS: L4 (Analyze)

List of some topics for Experiments

1. Design of linear op-amp circuits.
2. Design of non-linear op-amp circuits.
3. Design of active filters using op-amp.
4. Design of active diode circuits using op-amp.
5. Design of Comparators using op-amp
6. Timer IC-555.
7. Design of a stable multivibrator, Monostable multivibrator and VCO using IC-555.

Note: At least seven experiments are to be performed by the students from the above topics. The coursecoordinator may also design and set experiments in addition to above topics as per the scope and requirement of the syllabus.

MAJOR PROJECT & SEMINAR

Course Code: PROJ-EBME 432-P Course Credits: 8 Type: Compulsory Contact Hours: 18hrs/week Mode: Practical session	**Course Assessment Methods (Internal: 30; External: 70)** Internal continuous assessment of 30 marks on the basis of class performance and attendance in practical classes. For the end semester practical examination, the assessment will be done out of 70 marks by the external and internal examiners.

Prerequisite: Basic knowledge and understanding of principles & applications of Electronics & Biomedical Engineering.

Sr. No.	Course Outcomes At the end of the semester, students will be able to:	RBT Level
CO-1	Defining a relevant problem.	LOTS: (Remember)
CO-2	Understanding the materials & methods for problem solving.	LOTS:L2 (Understand)
CO-3	Knowledge & designing of the equipment required.	LOTS: L3 (Apply)
CO-4	Improving the soft skills.	HOTS: L4 (Analyze)

Students can start a new project or can continue their minor project taken up in 7th semester if, it is extendable.Each student is required to submit a project report in the department and give a presentation on the same beforethe internal committee for internal awards (30 marks).

For external awards (70 marks) students will be examined by internal & external examiners by live demonstration of the project followed by viva.